

Herbs, health, and *Heliotropium*

An intriguing piece of detective work by CSIRO scientists in two Divisions — Animal Health and Plant Industry — has helped shed new light on some of the risks associated with drinking certain 'herb teas'.

The work stemmed from an unfortunate incident that occurred in Hong Kong, in which four young women drank a herb tea medicine over a number of weeks as a treatment for psoriasis, a skin condition generally found on the scalp. All four eventually

developed a severe disorder termed veno-occlusive disease, and one subsequently died.

In veno-occlusive disease, fibrous tissue develops in and around the small branches of the hepatic vein in the liver and eventually blocks the vessels. The obstruction damages the liver and, if severe, the resulting liver failure causes death.

The condition has several causes, but the medical profession already knew about its association with certain herb teas, because the disease was common in Jamaica, where a drink called 'bush-tea' (made from the leaves of the plant *Crotalaria*) was popular.

Many plants contain bitter compounds, termed alkaloids, that are poisonous in varying

degrees to animals — and *Crotalaria* is one. It contains pyrrolizidine alkaloids, which are also found in other common plants such as the introduced weed Paterson's curse/salvation Jane (*Echium plantagineum*).

Indeed, those pyrrolizidine alkaloids are responsible for the weed's eventual toxicity to stock.

The summer-growing weed heliotrope (*Heliotropium europaeum*), originally from the Mediterranean but now growing in much of Australia, also has pyrrolizidine alkaloids — specifically lasiocarpine and heliotrine. This weed occupies several thousand square kilometres of grazing land and, because of the action of its alkaloids, shortens the

productive life of sheep that graze it.

When Dr Claude Culvenor of the Division of Animal Health's laboratory in Melbourne read about the Hong Kong incident, and the belief of the doctors there that they were witnessing veno-occlusive disease caused by pyrrolizidine poisoning, he thought he could help. He is an expert on the chemistry of pyrrolizidines and their effects.

The Hong Kong team showed by analysis that pyrrolizidines were present but were unable to identify the plants from which the herbal medicine — dried and finely chopped material — had derived. So they sent Dr Culvenor a sample of the leaf fragments.

Using the sensitive technique of mass spectroscopy, he and his colleagues Dr John Edgar and Mr Les Smith were able to detect the presence of compounds that, in their mass and charge, corresponded to heliotrine and lasiocarpine. Gas chromatography, a means of separating a mixture of compounds, confirmed the identity of those pyrrolizidine alkaloids.

Now, heliotrine and lasiocarpine are only known to occur in plants of the genus *Heliotropium*, so a partial identification had already been achieved. But a full identification that included the species was obviously desirable.

Fortunately, among the chopped leaves were several seeds. Some of these contained the same alkaloids as the leaves, and they were sent to Mr Roy Pullen and Mr Lyn Craven, in the Division of Plant Industry in Canberra.

There the seeds were allowed to germinate under controlled quarantine conditions, and the resulting plants flowered and produced seed. They could then be positively identified. They did indeed belong to the genus *Heliotropium* and the species

The innocuous-looking heliotrope, a source of dangerous alkaloids, and now found in many parts of Australia.



The homely-sounding comfrey — in this case, Russian comfrey, *Symphytum laplandicum* — is also toxic.

was *H. lasiocarpum* Fisch and Mey, a specimen recorded in the CSIRO herbarium. (The Royal Botanic Gardens in Edinburgh confirmed the identification.)

This species of *Heliotropium* — a very close relative of *H. europaeum* — occurs largely in the Middle East, south-western Asia, and Pakistan. The herbal medicine had been brought into Hong Kong from India.

Scientists have known about this plant's toxicity to humans for many years. Russian workers recognised it as the cause of epidemics of liver disease in Uzbekistan in the 1930s and '40s.

The locals called the resulting illness camel-belly disease, because of the swollen liver and the accumulation of fluid in the abdomen. They associated the disease with bitter-tasting bread, and the growth of a local weed with fine seeds.

This was *Heliotropium lasiocarpum*, and, growing among the wheat, its alkaloid-containing and hence bitter-tasting seeds contaminated the wheat crop and found their way into the grain and bread.

Despite scientific knowledge that *H.*

lasiocarpum was poisonous, some herbalists in Hong Kong, apparently in ignorance of its properties, use it, and their patients suffer the consequences.

Another plant in the same family is *Symphytum officinale*, perhaps better known as comfrey, and popular as a 'health tea' in Britain and the United States, where cases have been reported of liver disease due to its excessive use. Comfrey went through a stage of popularity in Australia, both for use as a herbal medicine and as a salad, before its alkaloid content and toxicity were revealed by Dr Culvenor and his team.

Neither comfrey nor *H. lasiocarpum* is now on the list of herbs allowed into Australia for use in herbal remedies.

Finally, some good news about plants in the *Heliotropium* genus: it's possible that some of their chemicals may one day have a use in therapy for certain cancers. Most pyrrolizidines are cytotoxic — that is, they can kill cells. A pyrrolizidine alkaloid from the plant *H. indicum* will kill tumour cells; unfortunately, its toxic side-effects — among them liver damage — are too great for its general use.

Perhaps one day an artificially modified form may turn out to be an anti-tumour agent with only minimal side effects. Meanwhile it's probably safest to avoid pyrrolizidine alkaloids — for ourselves or our animals — as much as possible.

Roger Beckmann

Heliotropium lasiocarpum

Fisch and Mey identified as a cause of veno-occlusive disease due to a herbal tea. C.C.J. Culvenor, J.A. Edgar, L.W. Smith, C.R. Kumana, and H.J. Lin. *The Lancet*, 1986, **1** (8487), 978. Paterson's curse and toxic alkaloids. C.C.J. Culvenor. *Search*, 1985, **16**, 219-23.